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To Dr. A. C. Shepley
with compliments from
C. Strickland

SHORT KEY
TO THE IDENTIFICATION OF THE
LARVÆ OF THE COMMON
ANOPHELINE MOSQUITOS
OF THE
MALAY PENINSULA

BY,

C. STRICKLAND, M. A., B. C., Cantab; F. R. G. S.,

illustrated by Miss K. O'Connor,

(FOR THE USE OF MEDICAL OFFICERS, AND OTHERS)

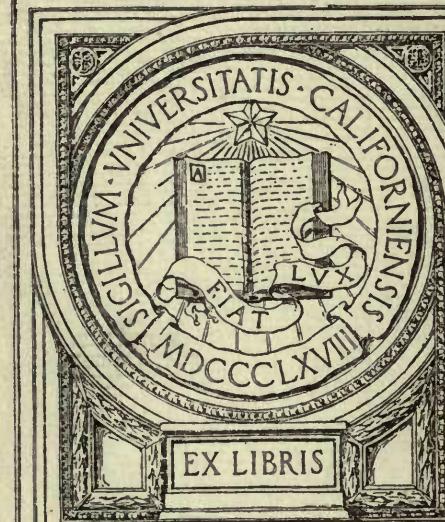
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PREFACE

At the request of several medical men I have prepared the following short key to the common anopheline larvæ of the Malay Peninsula as a sequel to my "Short Key to the Anopheline Mosquitos of Malaya," which appeared a short time back.

There are certainly advantages in being able to identify the larva. For instance if it be examined immediately it is caught, and the species determined, one is saved the trouble of looking after a number of hatching-out bottles for perhaps a considerable period. Moreover in hatching-out bottles many larvæ die, and then if they have not been already identified valuable information may have been lost.

A disadvantage is that a microscope must be used; which is not necessary for the adult.

The larva is collected in the various ways which the collector has devised, it is brought home in the waters of its birth, and forthwith killed by being placed in a mixture of 50% alcohol and 4% formalin (in which it can also be preserved,) or it may be allowed to die from natural causes. For examination under the microscope it is placed on a glass slide and covered with a glass slip: a one sixth-inch objective gives sufficient magnification.

It is possible, if the larva is well-grown, to identify every species of Malayan anopheline with certainty. But this Key applies only to the commoner species. The rare species are not included in the Key.

Some of these rare species are so like common species, in their larval characteristics, that without the most careful examination a mistake might be made when trying to identify a specimen, but then no great harm would result in mistaking these rare species for even bad carriers, unless too much significance is attached to the finding of what would probably, owing to the rarity of the species, be only a single specimen.

On the other hand some rare species have very distinct larval characteristics, for which the observer will find no counterpart in the following pages, but they can be of little or no epidemiological importance and can be disregarded.*

The larva must be well-grown, if this Key is to be used; because if the larva is young, in some species it approximates in character so much to other species that it might be confused with the other species.

No antimalarial campaign can be intelligently and economically carried out without accurate measurement of all the factors concerned in the production of the disease, and the discovery of one larva of a carrying species should not be a signal for panic-stricken antimalarial works. It should only be considered as possibly an important piece of epidemiological evidence, and as only a very gross piece of espionage which has been accomplished by the Intelligence Department in the campaign.

I am greatly indebted to Miss K. O' Connor for the trouble which she has bestowed upon the figures.

*It would be interesting to refer such forms in their preserving fluid to some expert.

THE GENERAL STRUCTURE OF A LARVA.

For the purposes of this Key it is only necessary to draw attention to those parts of the head, thorax, or abdomen, of the larva, which will be taken to illustrate the specific differences.* If these parts are absent from any larva which is being examined, the larva is not anopheline, however much it may have looked like one to the naked eye.

THE HEAD.

The head of every anopheline larva is adorned anteriorly by three pairs of hairs, called the clypeal hairs, the anterior-external, the anterior-internal, and the posterior, (see for example Plate I, figures 1 & 2); they will be referred to hereafter simply as external, internal, posterior.

The antenna in certain species bears on its inner side a strongly branched hair, (see Plate VII.).

THE THORAX.

Over the promontory of the thorax are groups of hairs, called the anterior thoracic hairs. (see Plate I, figures 1A, 2A.).

THE ABDOMEN.

On certain segments of the abdomen are borne laterodorsally a pair of fan-shaped hairs called the palmate hairs, (see for example Plate III, figures 1A, 2A.). This is with the exception of the species *umbrosus*, which is remarkable in that it does not possess any palmate hairs, a fact which Stanton was the first to discover.

*Christophers has observed that for the use of a key the most unvarying structures should be taken. Where therefore any possibility exists for confusion to arise in the following descriptions, from any "inherent variability" of the forms given, an alternative structural point will be given in a footnote.

I

EXAMINE THE CLYPEAL HAIRS.

By the examination, two species, *sinensis* and *barbirostris*, can be distinguished from every other species, although not from one another; two others, *maculatus* and *karwari*, likewise can be distinguished from every other species but not from each other: and seven, *umbrosus*, *aitkeni*, *albirostris*, *kochi*, *fuliginosus*, *rossi*, and *ludlowi*, can be absolutely identified.

sinensis and *barbirostris* must be differentiated by an examination of the anterior thoracic hairs, which Dr. Stanton, who has enriched our knowledge of Malay mosquitos so much, has discovered are distinct in the two species. Dr. Stanton has very kindly allowed me to illustrate this distinction here.

maculatus and *karwari* can be differentiated by an examination of the palmate hairs, a discovery made independently by Dr. Stanton and myself.

PLATE I

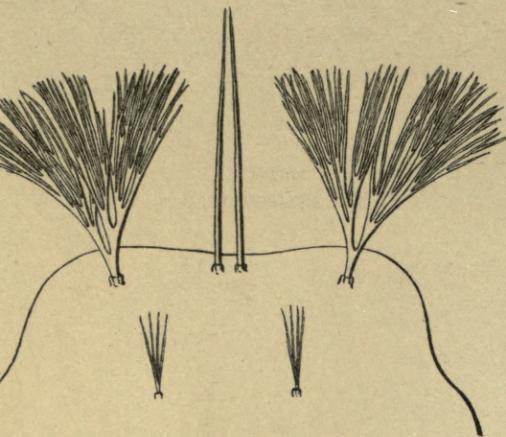


Figure 1
barbirostris x 525

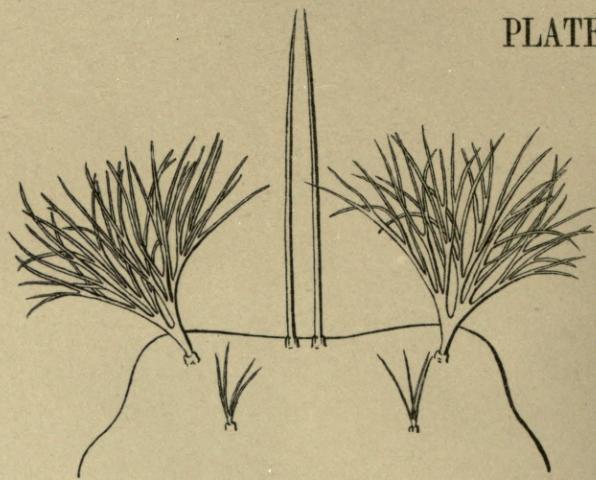


Figure 2
sinensis x 525

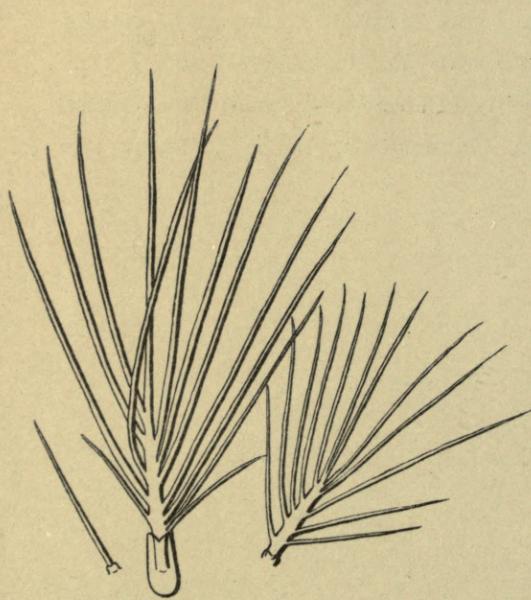


Figure 1 A
barbirostris x 525
left anterior thoracic hairs

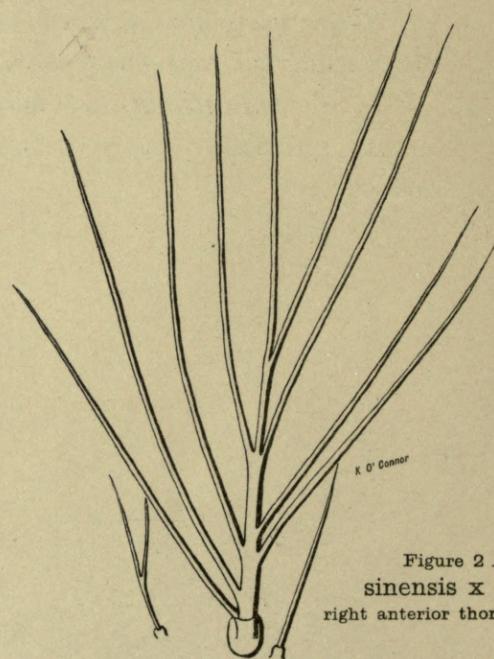


Figure 2 A
sinensis x 525
right anterior thoracic hairs

If,

the species is,

1. the internal clypeal hairs are close together, and the external
are thickly branched, (see Plate I, figures 1 & 2),
*barbirostris, or
sinensis.*

Then if the anterior thoracic hairs present the appearance
given in figure 1A, that is, with the internal one of the three hairs
strongly branched, (Stanton)
while if the corresponding hair is simple, or merely pronged, as in
figure 2A, (Stanton).
*barbirostris,
sinensis.*

PLATE II

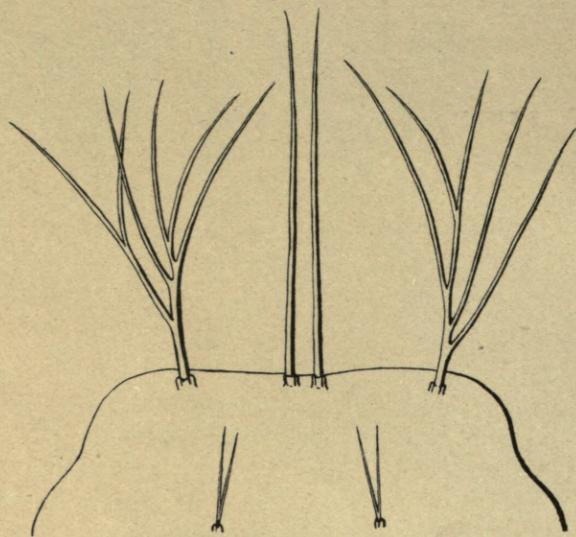


Figure 1
umbrosus x 525

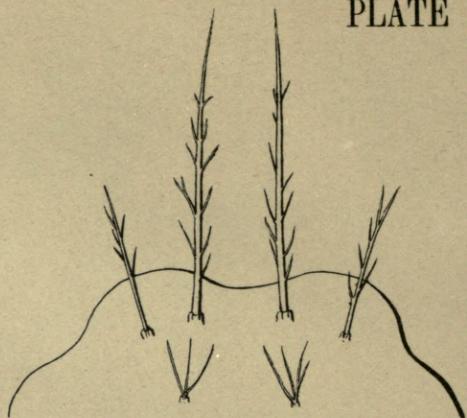


Figure 3
albirostris x 525

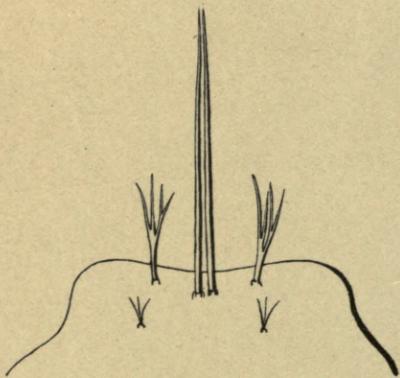


Figure 2
aitkeni x 525

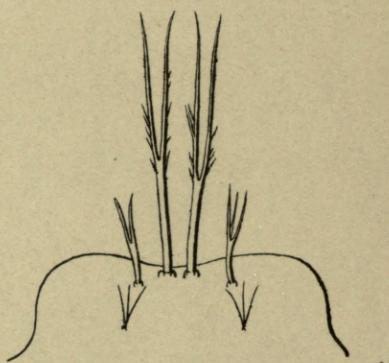


Figure 2 A
aitkeni x 525
R. O'Connor

*If**the species is,*

2. the internal are close together, and the external are only slightly branched, (as in Plate II, figure 1,) *umbrosus.**
3. the internal are of one of the types represented in Plate II, figures 2 & 2A, while the external are pronged, *aitkeni.*
4. the anterior hairs are strongly frayed, and the posterior branched, (Plate II, figure 3), *albirostris.†*

*There are no palmate hairs.

†Sometimes the anterior hairs of *albirostris* are less frayed, and as those of *maculatus* and *karwari* may be sometimes more than usually frayed, (see Plate III, figures 1 & 2), there may be a chance of confusing the first with the last two, but the branched posterior hair of *albirostris* settles the point, or if that is not seen, a reference to the palmate hairs, (compare Plate VI, figure 4, with Plate III, figures 1A & 2A.).

PLATE III



Figure 1
maculatus x 525

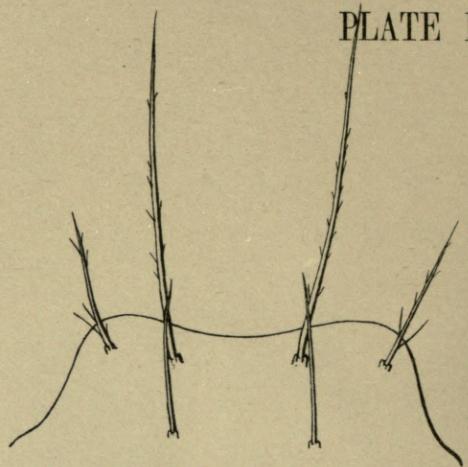


Figure 2
karwari x 525

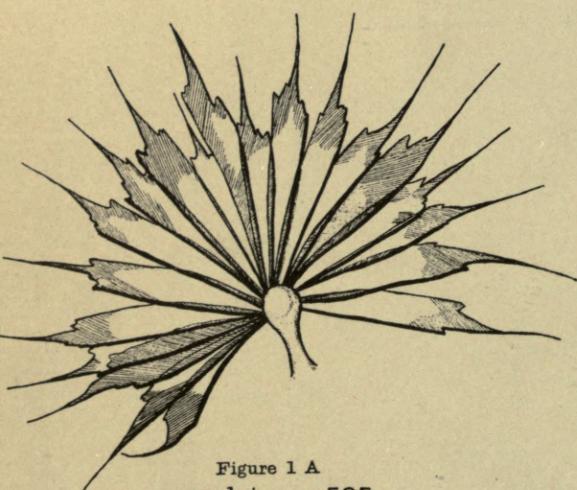


Figure 1 A
maculatus x 525
palmate hair

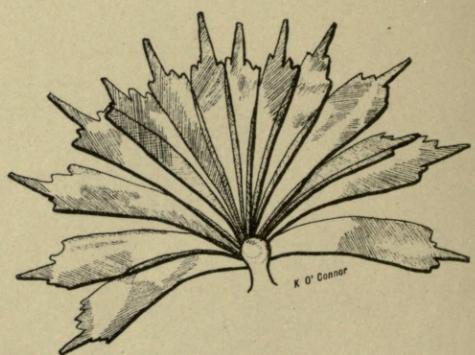


Figure 2 A
karwari x 525
palmate hair

K O' Connor

If,

the species is,

5. The anterior hairs are more or less frayed, the posterior simple, (Plate III, figures 1 & 2),

*maculatus** or
*karwari***

Then if the palmate leaflets are each provided with a definite short filament (Plate III, figure 1A),
whereas if each palmate leaflet is truncated (Plate III, figure 2A),

maculatus,
karwari.

*If the fraying is not seen *ludlowi* might be diagnosed. *ludlowi* should be ruled out by the absence of long terminal filaments to the palmate hairs, (see Plate VI, figure 2.).

PLATE IV

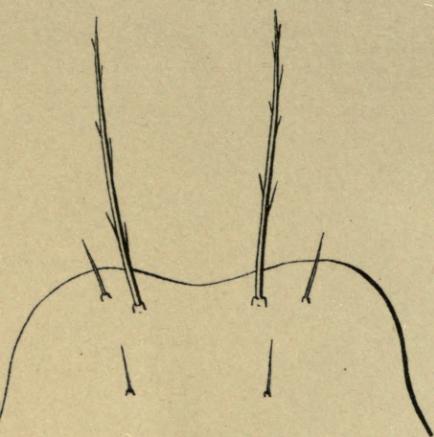


Figure 1
kochi x 525

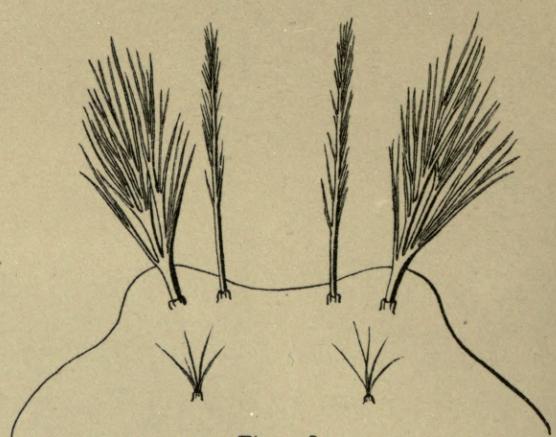


Figure 2
fuliginosus x 525

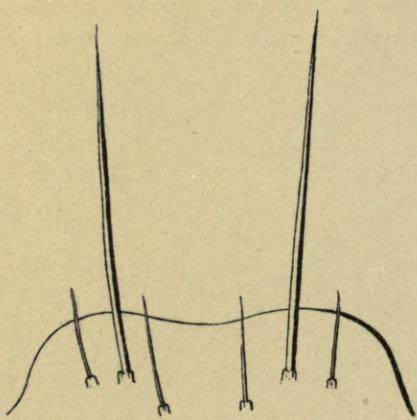


Figure 3
rossi x 525

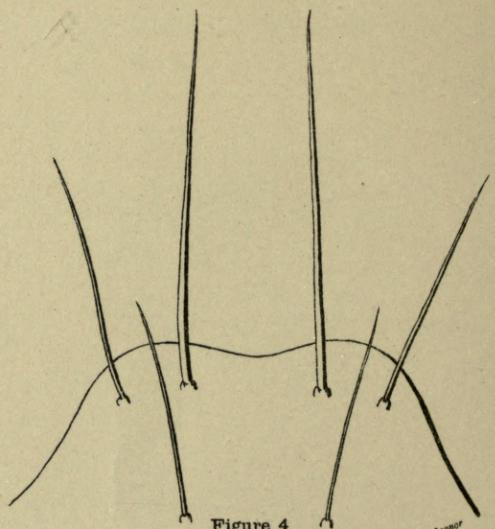


Figure 4
ludlowi x 525

K. O'Connor

*If,**the species is,*

6. the internal hairs are slightly frayed, the external simple,
very short, inconspicuous, and placed near to the internal, the
posterior short, simple, and placed externally to the internal
hairs, (Plate IV, figure 1), *kochi**.
7. the internal hairs are pinnate, the external strongly branched
forming a tuft, the posterior branched, (Plate IV, figure 2), ... *fuliginosus*.
8. the anterior hairs are simple and unfrayed, the posterior
likewise simple unfrayed, and lying in a position between the
internal hairs (Plate IV, figure 3), *rossi*.
9. the anterior are simple and unfrayed, the posterior likewise
and lying in a position behind the internal hairs, (Plate IV, figure 4), *ludlowi*.†

*Stanton says that *kochi* has unfrayed clypeal hairs. The fraying is at the best inconspicuous. If it cannot be seen, the characteristic external hair should be enough to settle the point, but there would be a possibility of confusion with *ludlowi*. From this it can be differentiated by the absence of a long filament to the palmate hairs, (compare Plate V, figure 4, with Plate VI, figure 2.).

†This might be confused with *kochi*, but a reference to the palmate hairs would suffice to distinguish it (compare Plate VI, figure 2, with Plate V, figure 4).

II

EXAMINE THE PALMATE HAIRS.

for confirmation of the determination made by examining the clypeal hairs.

In the case of the species *maculatus* and *karwari*, it is necessary to refer to the palmate hairs before one can diagnose these species, but in so many cases do these hairs afford valuable confirmatory evidence of what the species is, that we here include them all. The correct practice in rapidly diagnosing these larvae is undoubtedly to examine the clypeal hairs first, and then to turn to the palmate hairs.

PLATE V

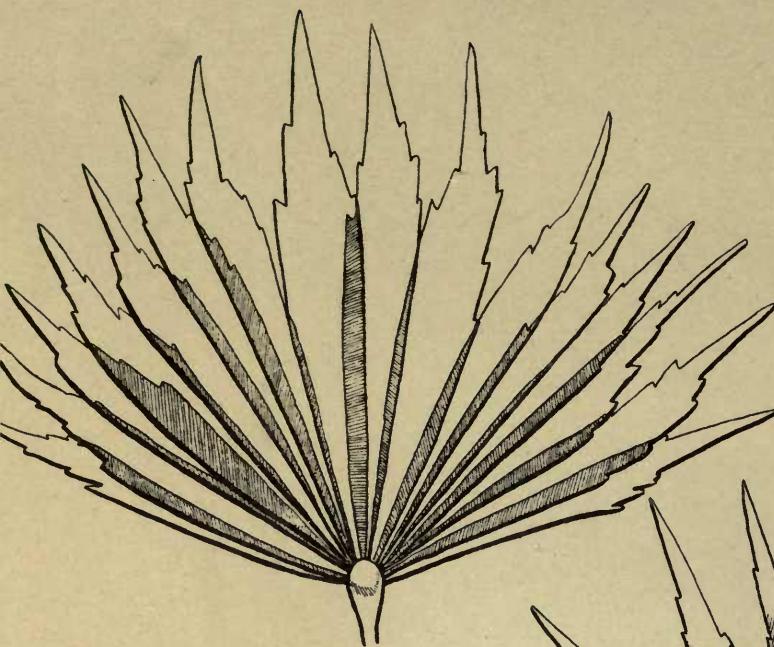


Figure 1
barbirostris x 525

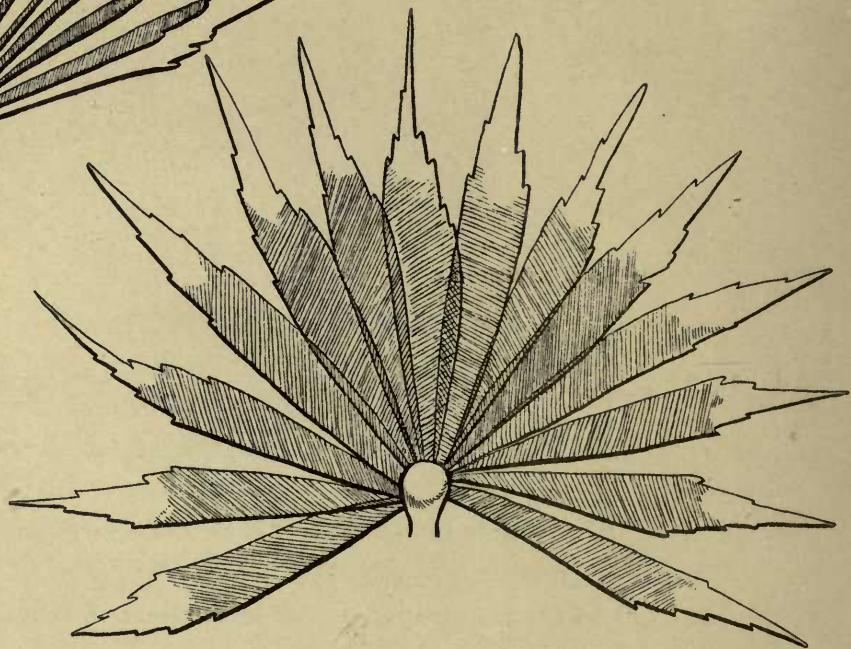


Figure 2
sinensis x 525

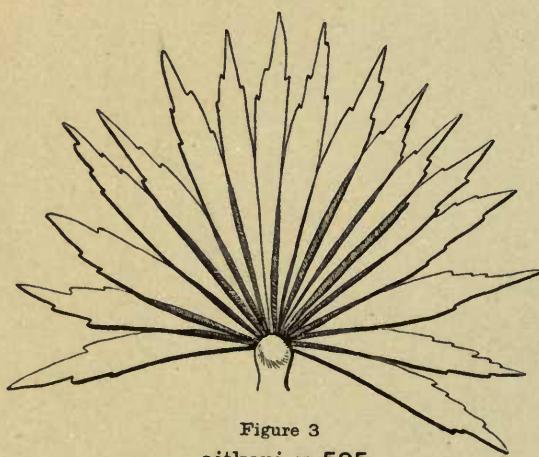


Figure 3
aitkenii x 525

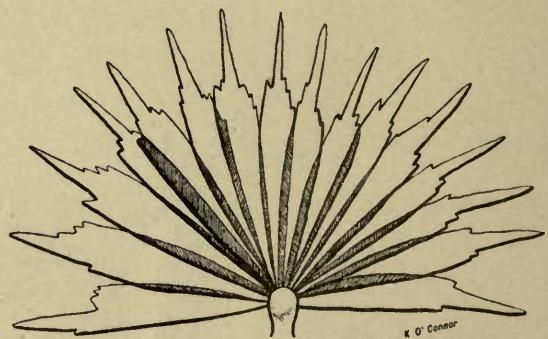


Figure 4
kochii x 525

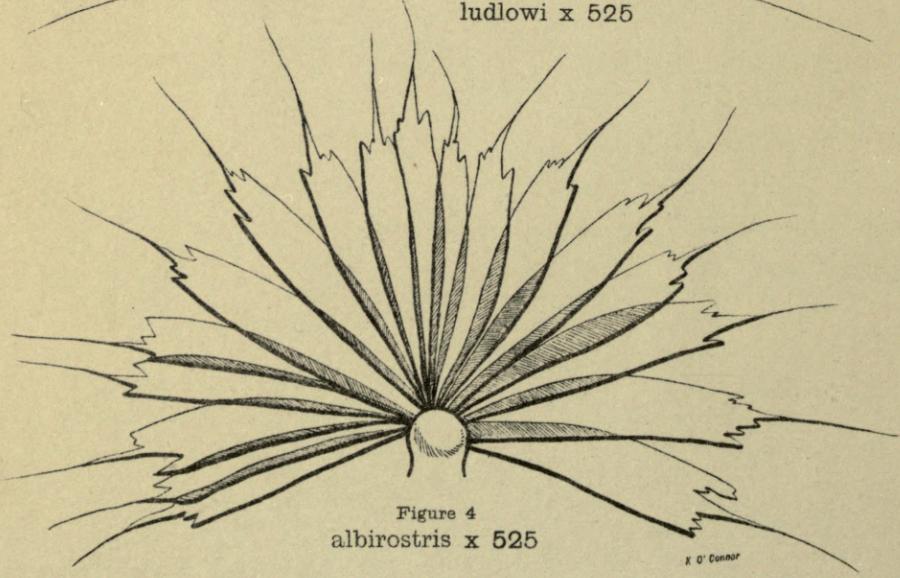
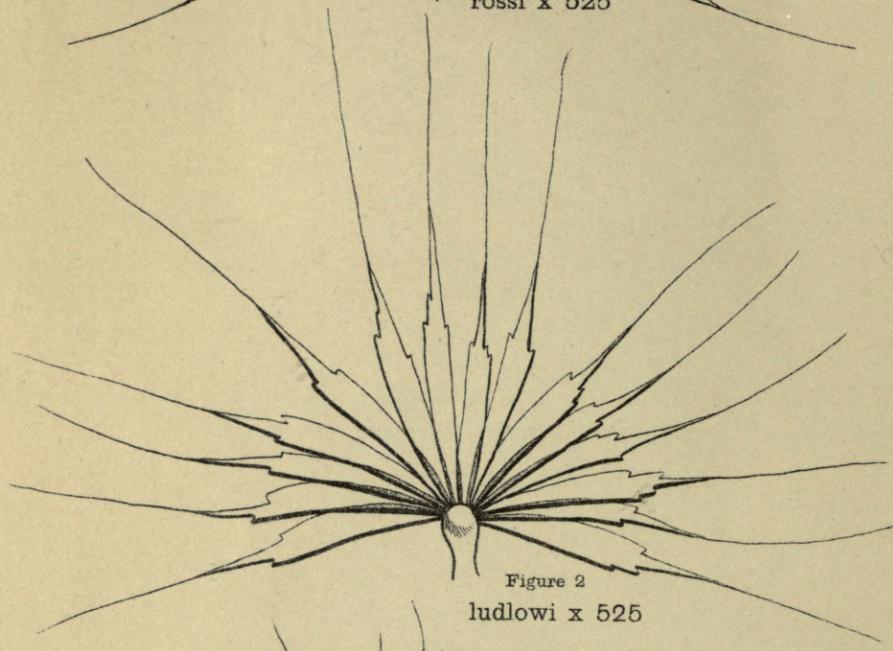
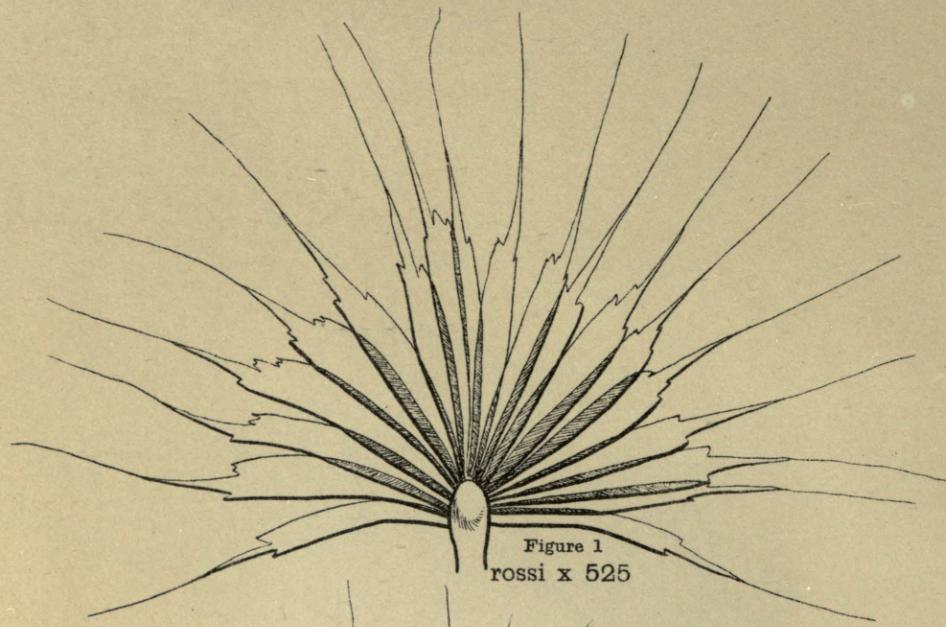
*If,**the species is,*

1. there are no palmate hairs,
2. the palmate hair leaflets are steeped, (Plate V, figures 1 - 4.),

*umbrosus.**barbirostris, or
sinensis, or
aitkeni, or
kochi.**

**kochi* can usually be distinguished from the others by the light pigmentation of the base of the leaflet, the narrowness of the leaflets, the slight steeping, and the translucency of the distal half.

PLATE VI



X O' Connor

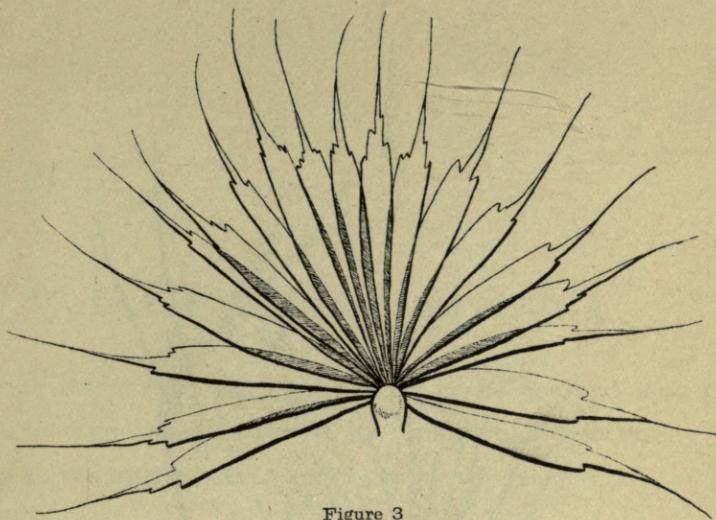


Figure 3
fuliginosus x 525

If,

the species is.

- 3. the leaflets are truncated, (see Plate III, figure 2A),
- 4. the leaflets have a short terminal filament, (see Plate III, figure 1A),
- 5. the leaflets have a long terminal filament, (see Plate VI, figures 1 - 4),

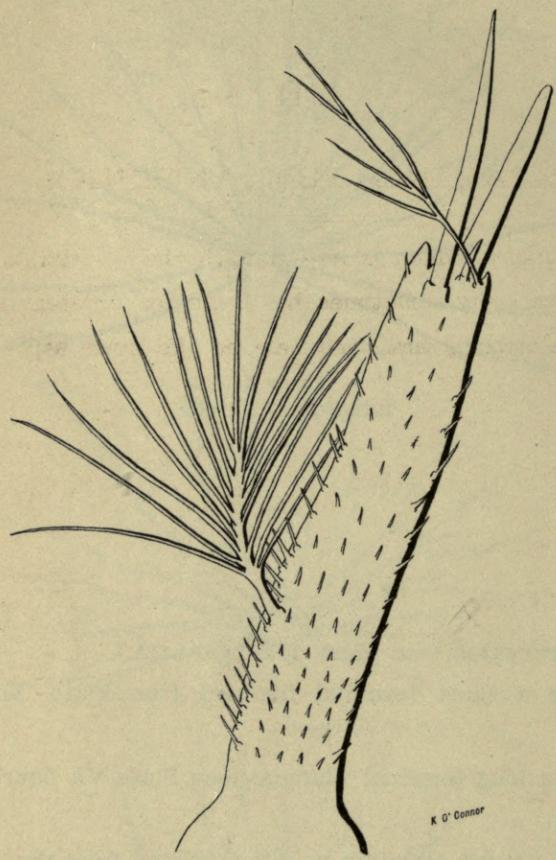
karwari.

maculatus.

rossi, or
ludlowi, or
fuliginosus, or
albirostris.

albirostris can almost certainly be differentiated from the others by the apparent origin of the filament from a very straight shoulder or even from a depression, (see figure 4, the right hand leaflet, which is typical.)

PLATE VII



K. O'Connor

III

EXAMINE THE ANTENNA.

A structure, which is important, as being peculiar to Christophers' protanopheline division, may sometimes be useful for differentiating two species. This structure is the strongly branched hair on the inner aspect of the antenna.

If,

the species is,

- | | | |
|------------------------|---|---|
| 1. the hair is present | | <i>barbirostris, or
sinensis, or
umbrosus, or
aitkeni</i> |
| 2. the hair is absent | | <i>albirostris, or
maculatus, or
karwari, or
kochi, or
ludlowi, or
rossi, or
fuliginosus.</i> |

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